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(54) **IMAGE DISPLAY SYSTEM AND METHOD OF DRIVING THE SAME**

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(57) **ABSTRACT**

An image display system includes a camera part and an image display part. The image display part includes a user analyzer, a gamma corrector, a gamma voltage generator, and a display panel. The camera part takes a picture of a user and generates a user image signal. The user analyzer calculates the user's viewing direction based on the user image signal. The gamma corrector generates a correction gamma value based on the viewing direction. The gamma voltage generator generates a gamma voltage based on the correction gamma value, and the display panel displays an image corresponding to the gamma voltage. Accordingly, the image display system provides the image having an optimized gamma curve to the user in real time even without a separate input from the user.

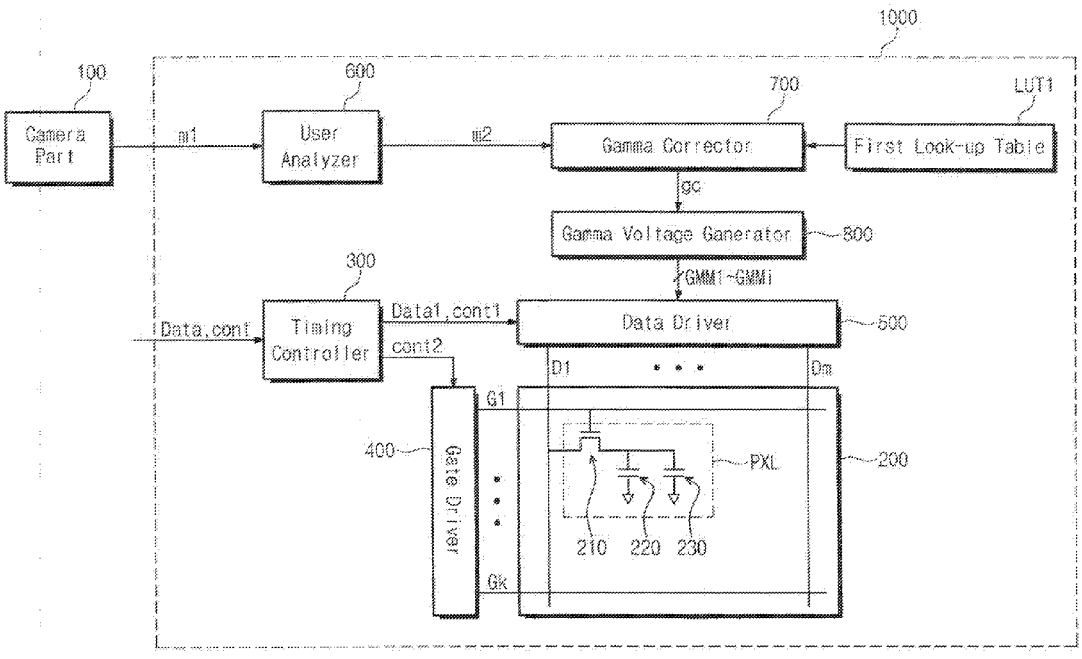


Fig. 1

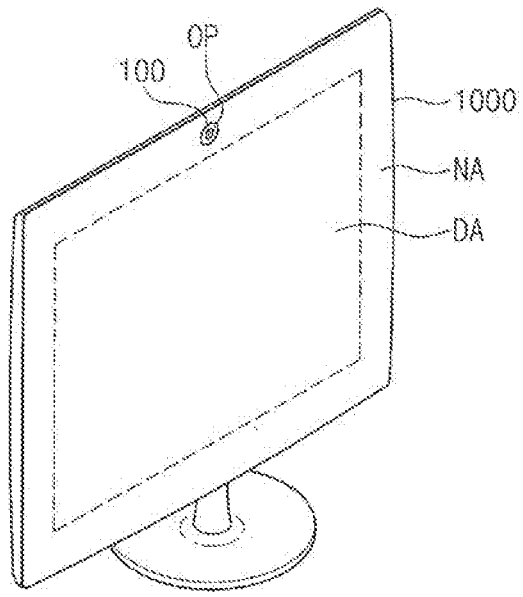


Fig. 2

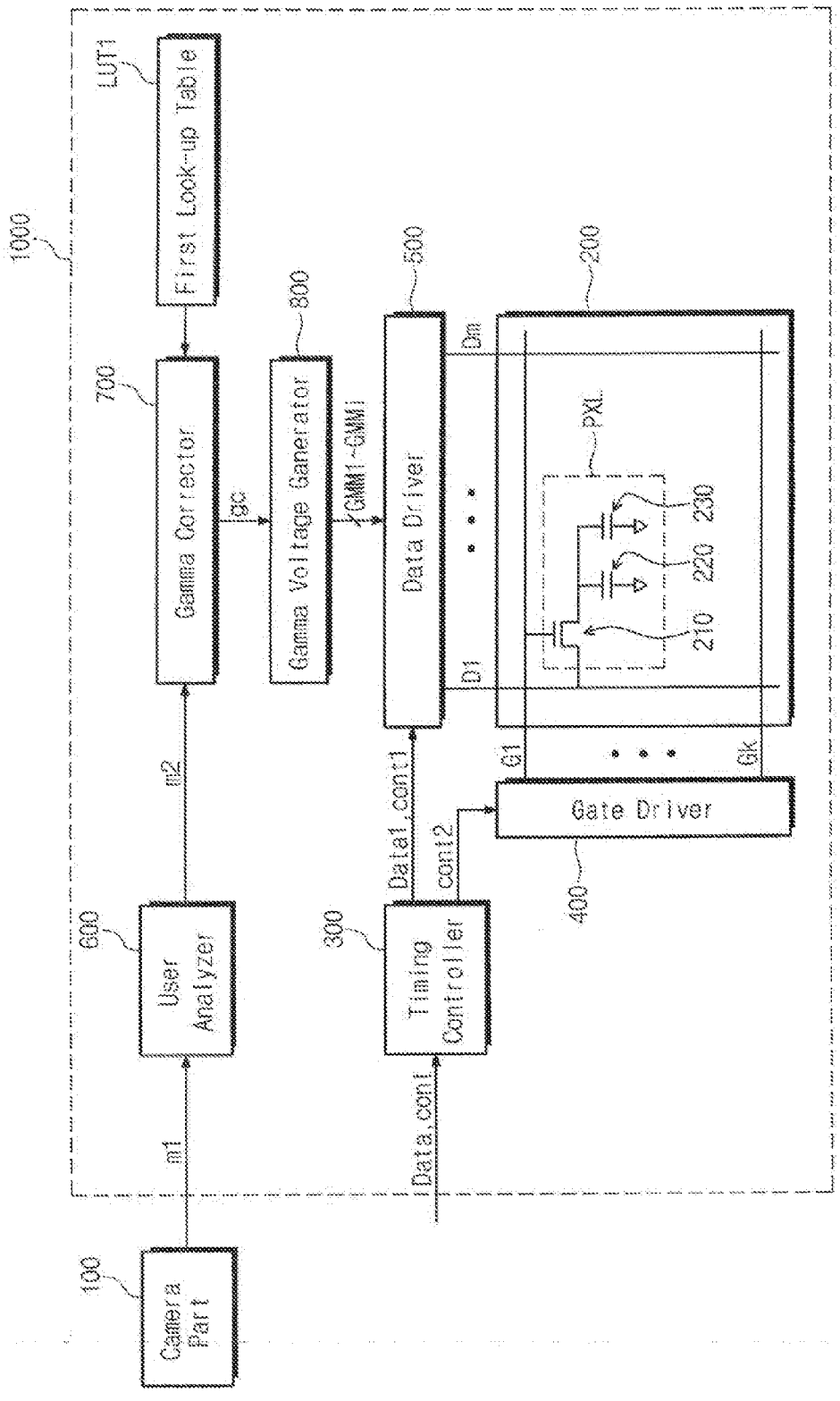

1000
LUT1
First Look-up Table
700
Gamma Corrector
gc
800
Gamma Voltage Generator
GMM1~GMMi
500
Data Driver
D1
Dm
200
PXL
230
220
210
G1
Gk
Gate Driver
400
Data1,cont1
cont2
300
Timing Controller
Data,cont
m2
600
User Analyzer
m1
100
Camera Part

Fig. 3

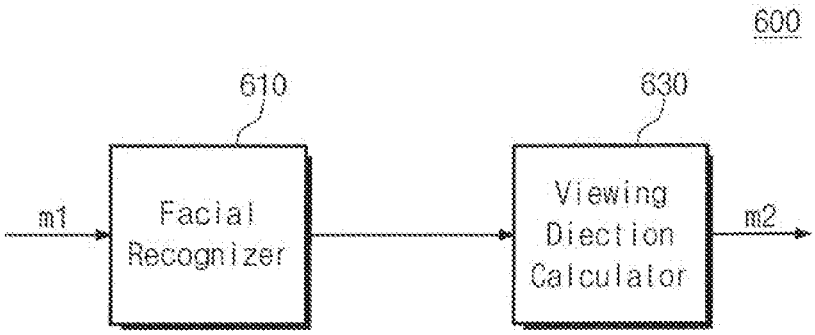

600
610
630
m1
Facial Recognizer
Viewing Diection Calculator
m2

Fig. 4

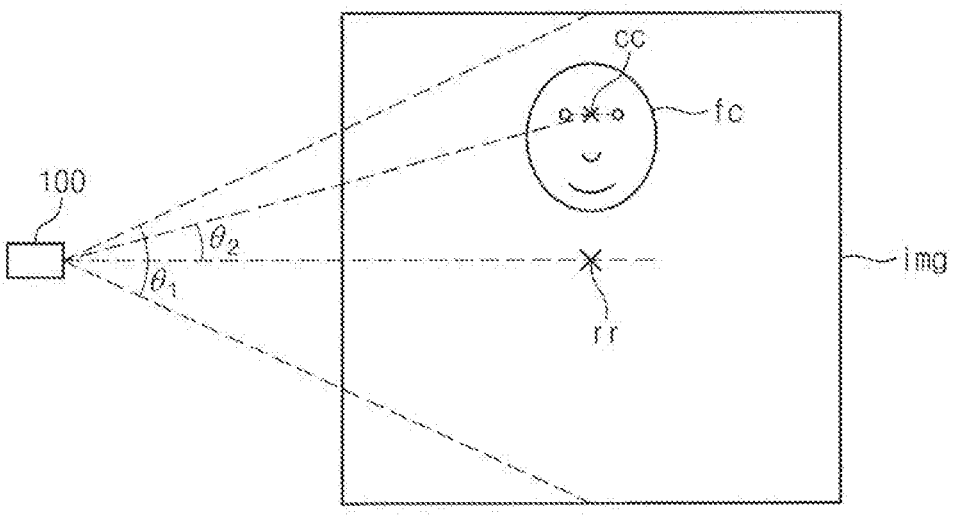

cc
fc
100
θ2
θ1
rr
img

Fig. 5A

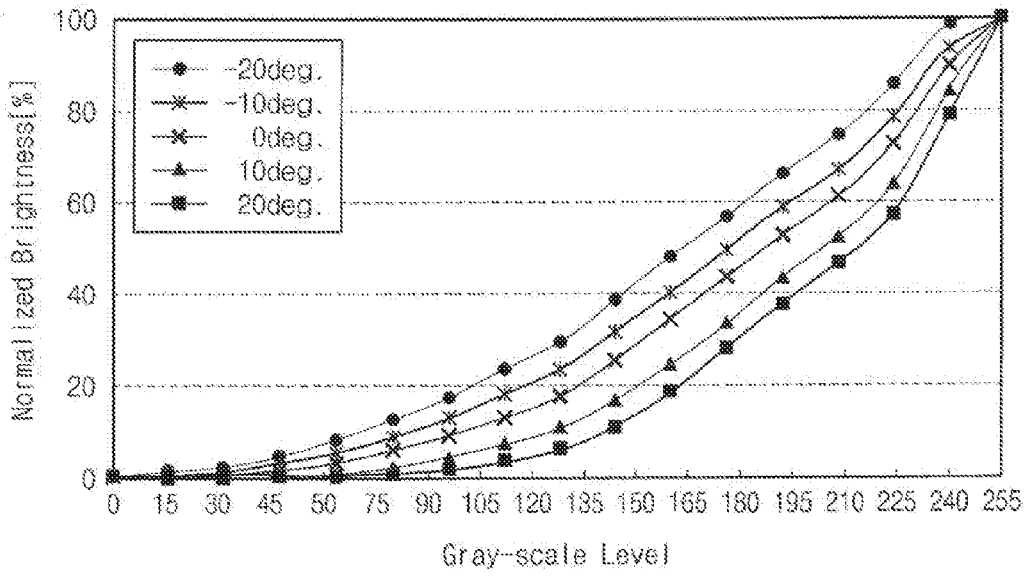
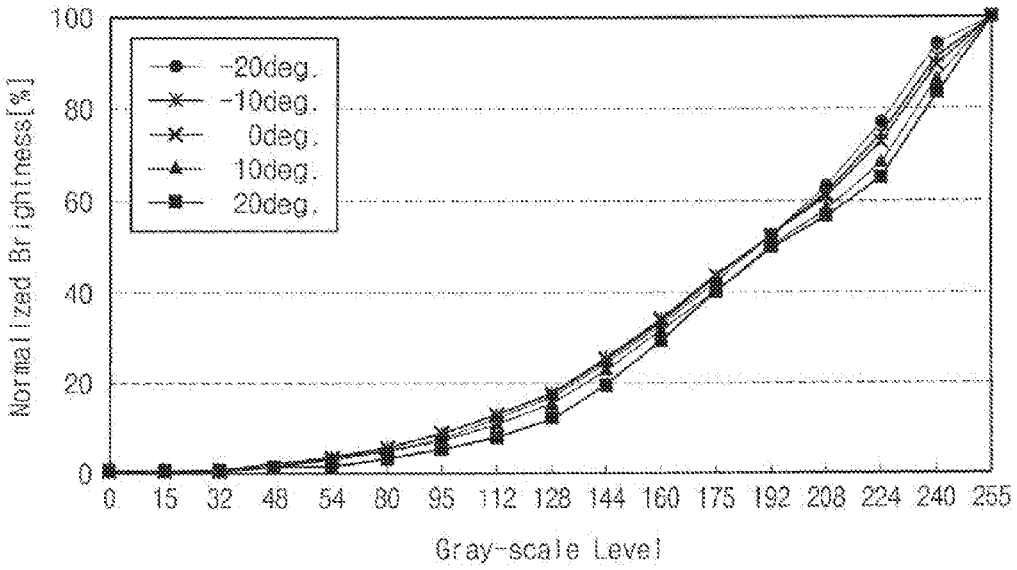

Normalized Brightness[%]
100
80
60
40
20
0
-20deg.
-10deg.
0deg.
10deg.
20deg.
0 15 30 45 50 75 90 105 120 135 150 165 180 195 210 225 240 255
Gray-scale Level

Fig. 5B


Normalized Brightness[%]
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80
60
40
20
0
-20deg.
-10deg.
0deg.
10deg.
20deg.
0 15 32 48 54 80 95 112 128 144 160 175 192 208 224 240 255
Gray-scale Level

Fig. 6

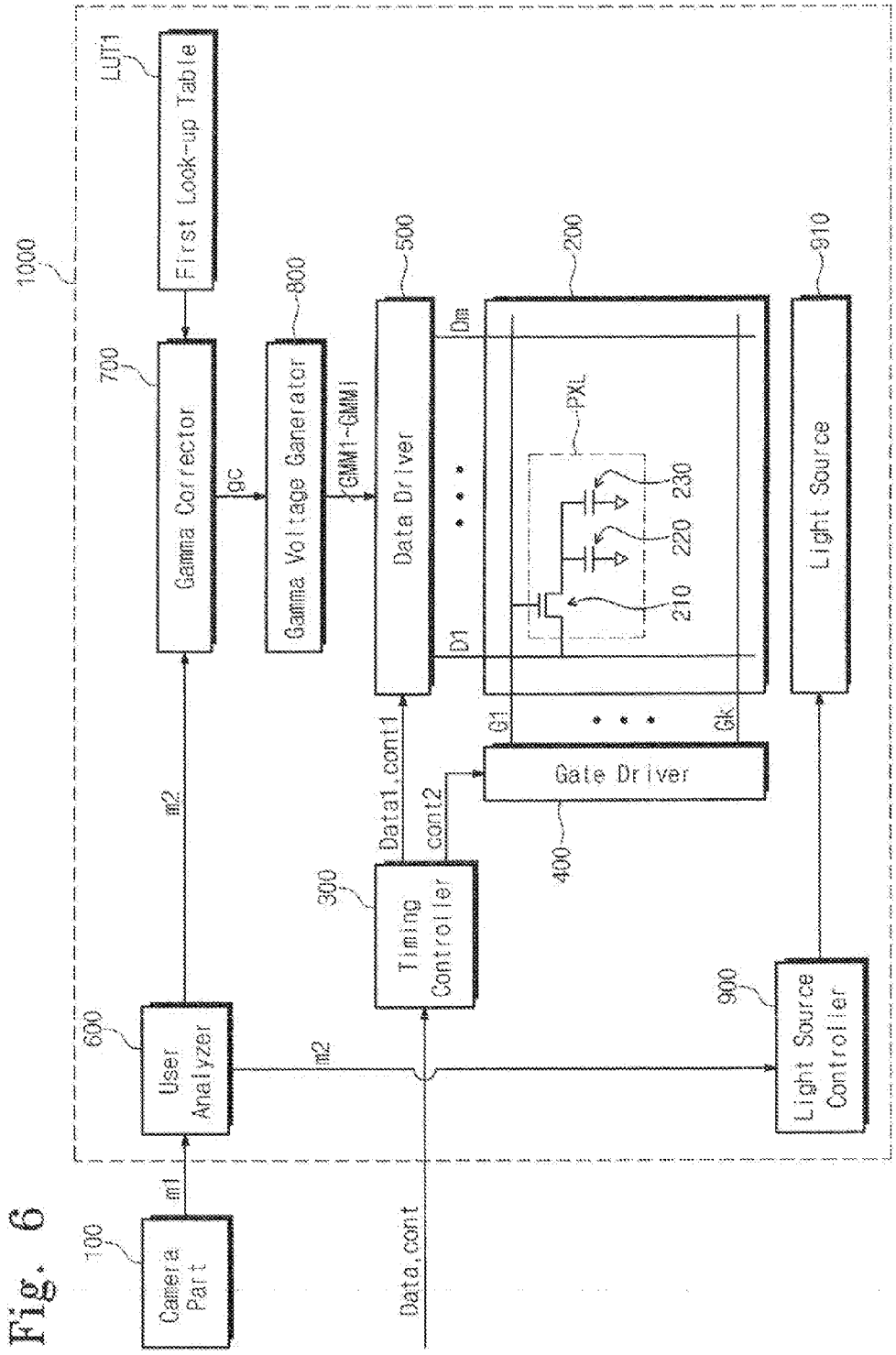
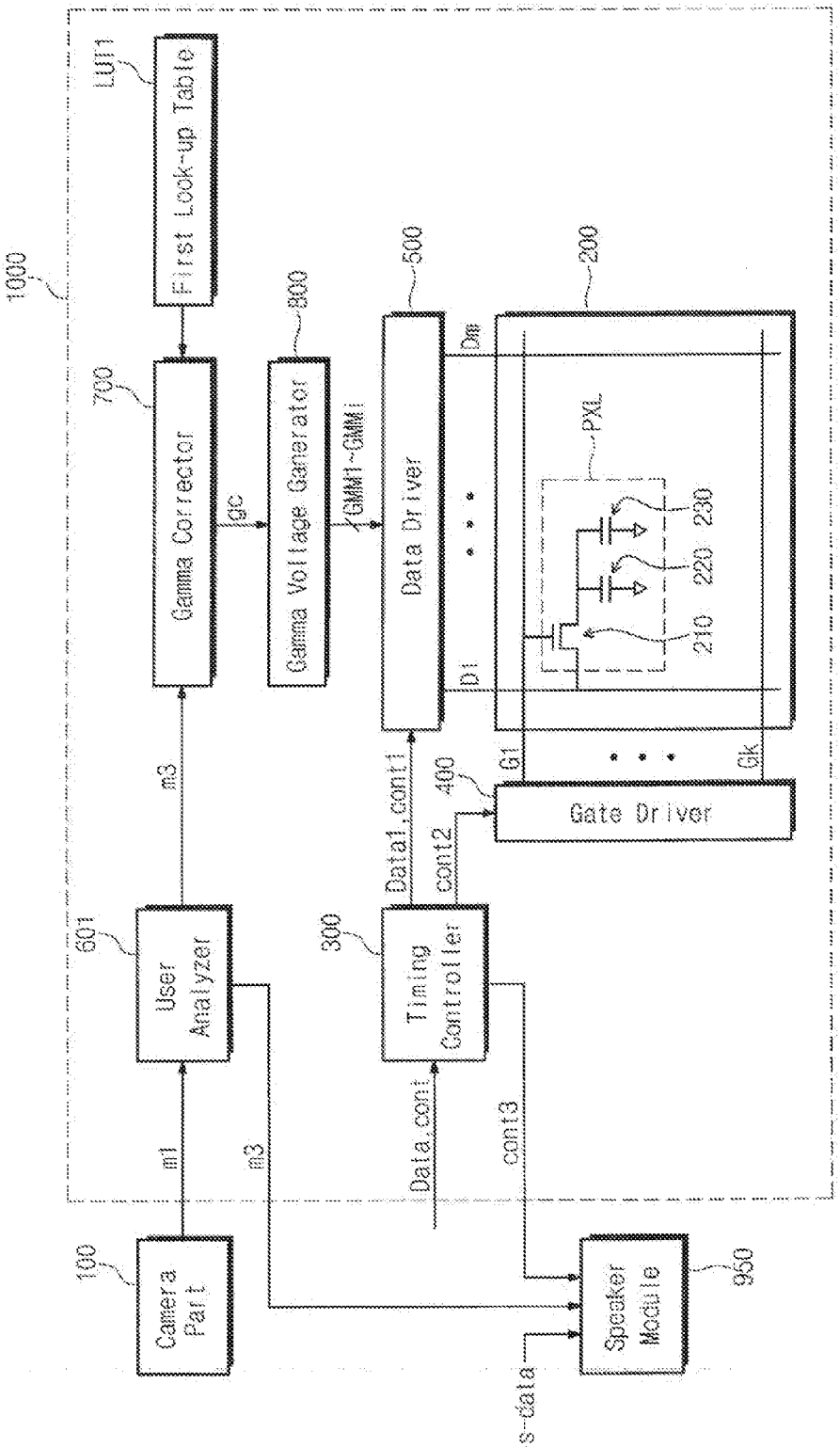

1000
LUT1
First Look-up Table
700
Gamma Corrector
gc
800
Gamma Voltage Generator
GMM1~GMMi
500
Data Driver
Dm
D1
200
PXL
230
220
210
910
Light Source
G1
Gk
Gate Driver
400
Data1,cont1
cont2
300
Timing Controller
m2
600
User Analyzer
m2
900
Light Source Controller
m1
100
Camera Part
Data,cont

Fig. 7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LUT1
First Look-up Table
700
Gamma Corrector
gc
800
Gamma Voltage Generator
GMMA1~GMMA
500
Data Driver
Dm
D1
200
PXL
210
220
230
G1
Gk
400
Gate Driver
Data1,cont1
cont2
601
User Analyzer
300
Timing Controller
m3
m1
m3
Data,cont
cont3
100
Camera Part
Speaker Module
950
s-data

Fig. 8

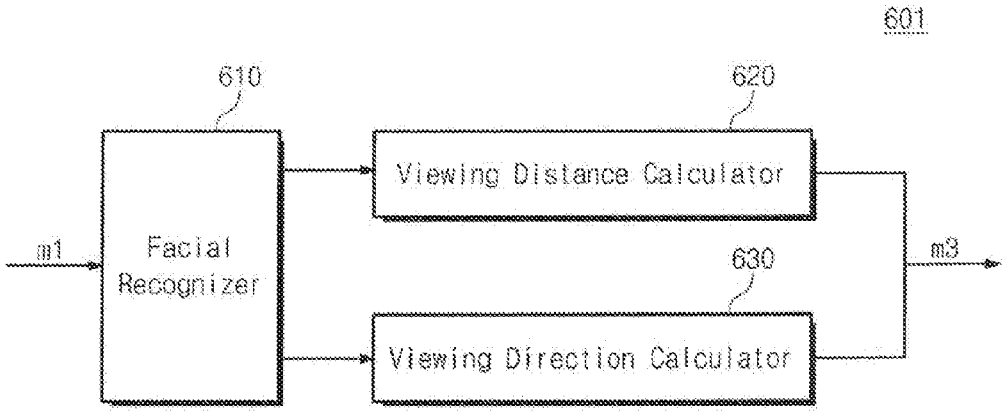
601
610
620
Viewing Distance Calculator
m1
Facial Recognizer
m3
630
Viewing Direction Calculator

Fig. 9

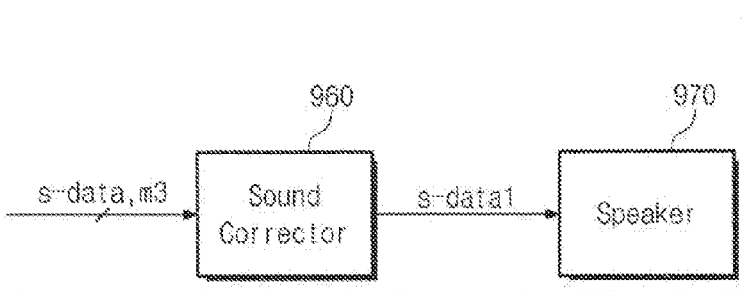
950
960
970
s-data,m3
Sound Corrector
s-data1
Speaker

Fig. 10

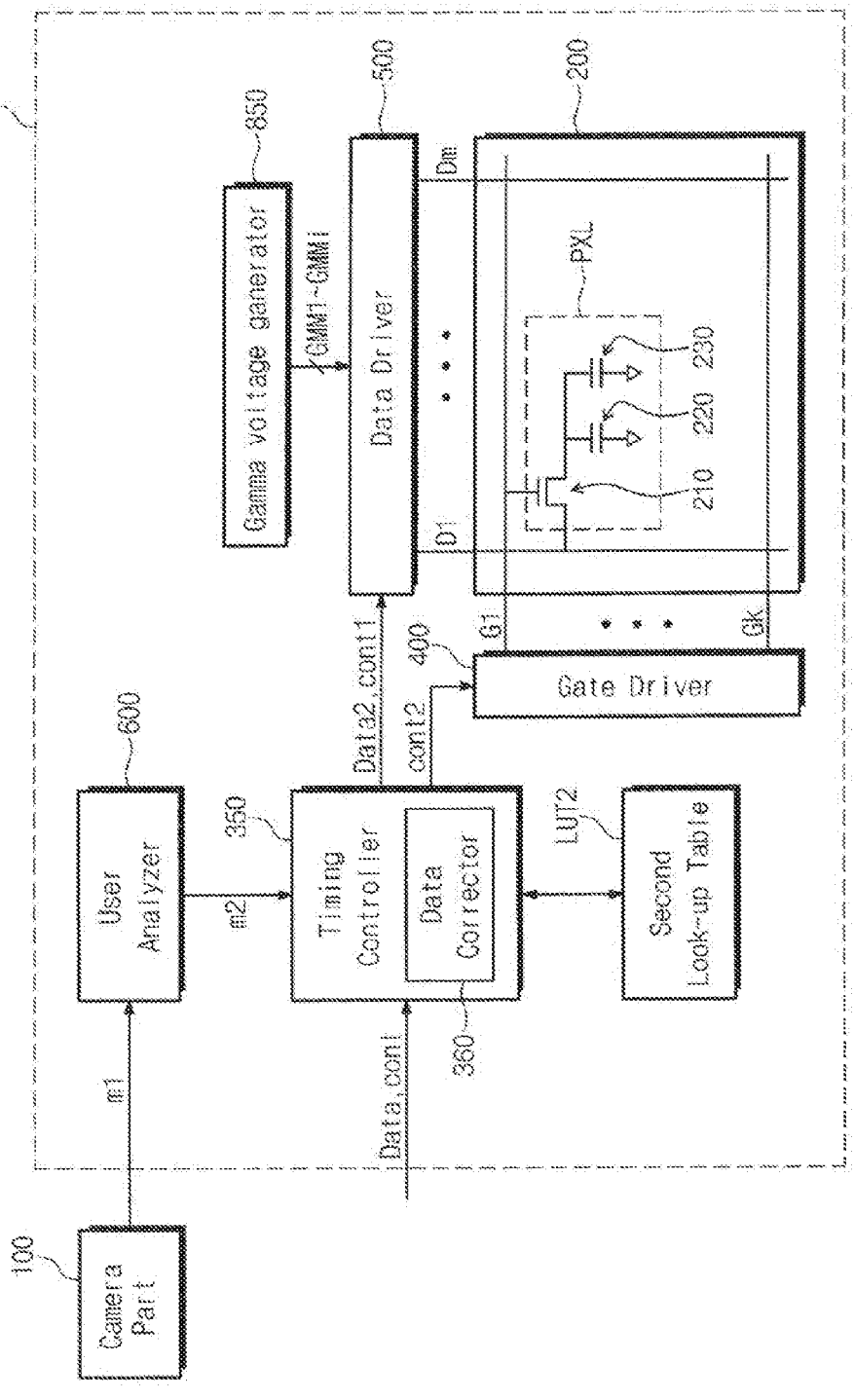
1000
100
Camera Part
fm1
600
User Analyzer
fm2
350
Timing Controller
Data Corrector
360
Data_cont
Data2_cont1
cont2
400
Gate Driver
G1
Gk
500
Data Driver
Dm
D1
850
Gamma voltage generator
GMM1~GMMi
200
PXL
210
220
230
LUT2
Second Look-up Table

Fig. 11

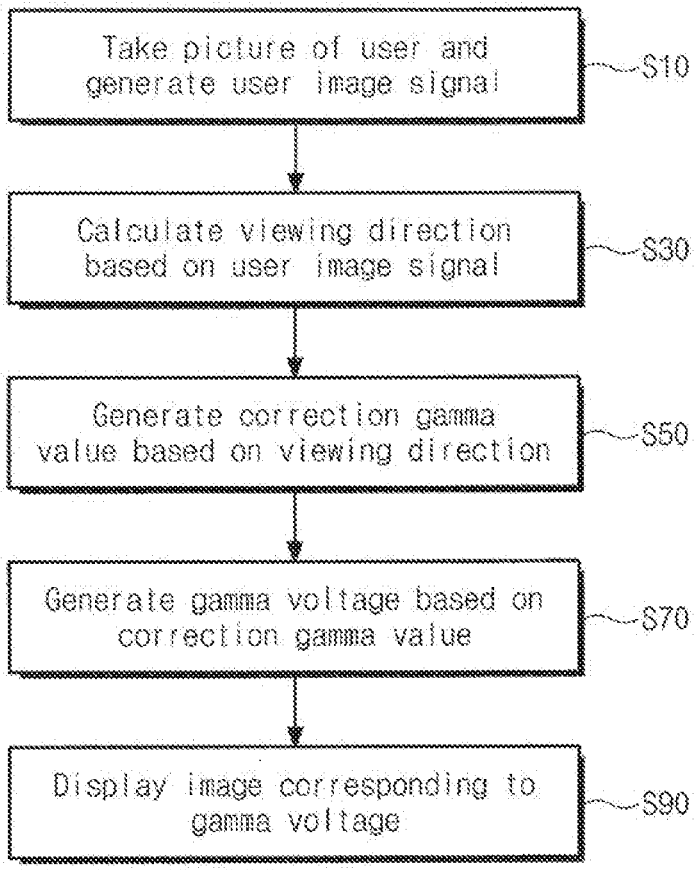
Take picture of user and generate user image signal
S10
Calculate viewing direction based on user image signal
S30
Generate correction gamma value based on viewing direction
S50
Generate gamma voltage based on correction gamma value
S70
Display image corresponding to gamma voltage
S90

Fig. 12

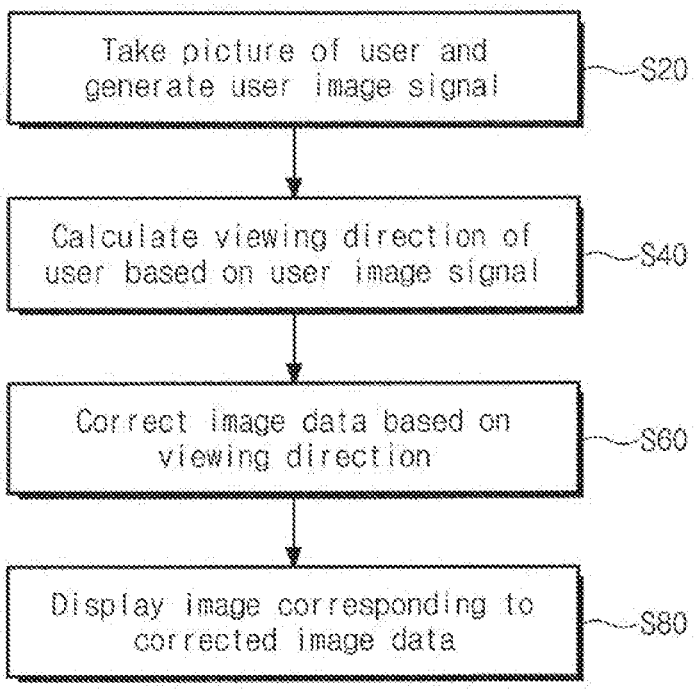
Take picture of user and generate user image signal
S20
Calculate viewing direction of user based on user image signal
S40
Correct image data based on viewing direction
S60
Display image corresponding to corrected image data
S80

IMAGE DISPLAY SYSTEM AND METHOD OF DRIVING THE SAME

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This U.S. non-provisional patent application is a divisional of U.S. application Ser. No. 13/613,660, filed in the U.S. Patent and Trademark Office on Sep. 13, 2012, which in turn claims priority under 35 U.S.C. §119 of Korean Patent Application No. 10-2012-0040401 filed on Apr. 1.8, 2012, the contents of which are herein incorporated by reference in their entirety.

TECHNICAL FIELD

[0002] Embodiments of the present disclosure relate to an image display system and a method of driving the same. More particularly, embodiments of the present disclosure relate to an image display system that can increase display quality in consideration of a user's viewing direction and a method of driving the same.

DISCUSSION OF THE RELATED ART

[0003] Various display devices for electronic devices, such as computer monitors, mobile phones, or television sets have been developed.

[0004] Gamma values of display devices are fixed when the display devices are initially designed, so that the display quality of the display devices depends on a distance from a user or the user's position.

SUMMARY

[0005] Embodiments of the present disclosure provide an image display system that can increase display quality and control image brightness and sound in consideration of a user's position and a method of driving the image display system.

[0006] An embodiment of the inventive concept provides an image display system includes a camera part and an image display part. The image display part includes a user analyzer, a gamma corrector, a gamma voltage generator, and a display panel.

[0007] The camera part takes a picture of a user and generates a user image signal. The user analyzer receives the user image signal and calculates the user's viewing direction based on the user image signal. The gamma corrector generates a correction gamma value based on the viewing direction. The gamma voltage generator generates a gamma voltage based on the correction gamma value. The display panel displays an image corresponding to the gamma voltage.

[0008] The user analyzer includes a facial recognizer and a viewing direction calculator. The facial recognizer receives the user image signal and recognizes the user's face, and the viewing direction calculator calculates the user's viewing direction based on a position of the face.

[0009] According to an embodiment, the image display system further includes a light source and a light controller. The light source provides light to the display panel. The light source controller controls a brightness of the light source based on the viewing direction.

[0010] According to an embodiment, the image display system further includes a speaker module. The speaker module includes a sound corrector and a speaker. The sound corrector receives a sound data and generates a corrected sound data based on the viewing distance and the viewing direction, The speaker receives the corrected sound data and outputs the sound.

[0011] An embodiment of the inventive concepts provide an image display system includes a camera part and an image display part. The image display part includes a user analyzer, a timing controller, and a display panel. The camera part takes a picture of a user and generates a user image signal. The user analyzer receives the user image signal and calculates the user's viewing direction based on the user image signal. The timing controller receives image data and corrects the image data based on the viewing direction. The display panel displays an image corresponding to the corrected image data.

[0012] An embodiment of the inventive concept provides a method of driving an image display system includes taking a picture of a user and generating a user image signal, calculating a viewing direction of the user based on the user image signal, generating a correction gamma value based on the viewing direction, generating a gamma voltage based on the correction gamma value, and displaying an image corresponding to the gamma voltage.

[0013] According to an embodiment, there is provided an image display system including a camera configured to generate a user's image signal, a user analyzer configured to generate the user's positional information from the image signal, and a gamma corrector configured to correct a first gamma value into a second gamma value corresponding to the positional information.

[0014] The image display system may further include at least one of a speaker module configured to output a sound whose magnitude corresponds to the positional information, a light source controller configured to adjust brightness of a light source according to the positional information, or a data corrector configured to change a data format of an image corresponding to the user's image signal into another data format.

[0015] According to the embodiments, the gamma value or the image data is corrected based on the user's viewing direction in real time, and thus visibility of the image display system may be increased regardless of the user's position.

[0016] The image display system may allow the brightness and the sound of the image to be suited to the user in consideration of the user's viewing direction.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The embodiments of the present invention will become readily apparent by reference to the following detailed description When considered in conjunction with the accompanying drawings wherein:

[0018] FIG. **1** is a perspective view showing an image display system according to an exemplary embodiment of the present invention;

[0019] FIG. **2** is a block diagram showing the image display system shown in FIG. **1**;

[0020] FIG. **3** is a block diagram showing the user analyzer shown in FIG. **2**;

[0021] FIG. **4** is a view for describing a process of calculating a user's viewing direction;

[0022] FIG. **5**A is a graph showing gamma curves according to view angles;

[0023] FIG. **5**B is a graph showing gamma curves obtained by compensating for the gamma curves shown in FIG. **5**A;

[0024] FIG. **6** is a block diagram showing an image, display system according to an exemplary embodiment of the present invention;

[0025] FIG. **7** is a block diagram showing an image display system according to an exemplary embodiment of the present invention;

[0026] FIG. **8** is a block diagram showing the user analyzer shown in FIG. **7**;

[0027] FIG. **9** is a block diagram showing the speaker module shown in FIG. **7**;

[0028] FIG. **10** is a block diagram showing an image display system according to an exemplary embodiment of the present invention;

[0029] FIG. **11** is a flowchart illustrating a method of driving an image display system. according to an embodiment of the present invention; and

[0030] FIG. **12** is a flowchart illustrating a method of driving an image display system. according to an embodiment of the present invention.

DETAILED DESCRIPTION

[0031] It will be understood that when an element or layer is referred to as being "on", "connected to" or "coupled to" another element or layer, it can be directly on, connected or coupled to the other element or layer or intervening elements or layers may be present. Like numbers may refer to like or similar elements throughout the specification and the drawings. As used herein, the term "and/or" includes any and ail combinations of one or more of the associated listed items.

[0032] As used herein, the singular forms, "a", "an" and the are intended to include the plural forms as well, unless the context clearly indicates otherwise.

[0033] As will be appreciated by one skilled in the art, embodiments of the present invention may be embodied as a system, method, computer program product, or a computer program product embodied in one or more computer readable medium(s) having computer readable program code embodied thereon. The computer readable program code may be provided to a processor of a general purpose computer, special purpose computer, or other programmable data processing apparatus. The computer readable medium may be a computer readable signal medium or a computer readable storage medium. The computer readable storage medium may be any tangible medium that can contain, or store a program for use by or in connection with an instruction execution system, apparatus, or device.

[0034] Hereinafter, embodiments of the present invention will be described in detail with reference to the accompanying drawings. The present invention may be embodied in various different ways and should not be construed as limited to the exemplary embodiments described herein.

[0035] FIG. **1** is a perspective view showing an image display system according to an exemplary embodiment of the present invention. FIG. **2** is a block diagram showing the image display system shown in FIG. **1**.

[0036] Referring to FIGS. **1** and **2**, the image display system includes a camera part **100** and an image display part **1000**.

[0037] The camera part **100** takes a picture of a user and generates a user image signal m**1**. For example, the camera part **100** takes a picture of a user positioned in front of the image display part **1000** at a predetermined distance and a predetermined angle, generates a user image signal m**1** including the user's position information, and applies the user image signal m**1** to the image display part **1000**. According to an embodiment, the camera part **100** includes a real time motion picture camera, and the user image signal m**1** includes a real time motion picture signal. The camera part **100** has a preset upper and lower view angle and a preset left and right view angle.

[0038] As shown in FIG. **1**, the camera part **100** is embedded in the image display part **1000**. According to an embodiment, the camera part **100** takes the picture of the user through an opening OP formed on a front portion of the image display part **1000**. However, the camera part **100** is limited as being positioned in the image display part **1000**. Alternatively, the camera part **100** is separated from the image display part **1000** and attached to an external side portion of the image display part **1000**.

[0039] The image display part **1000** includes a display area DA and a non-display area NA disposed adjacent to at least a portion of the display area DA. The opening OP is positioned at the non-display area NA and exposes the camera part **100**.

[0040] The image display part **1000** includes a display panel **200**, a timing controller **300**, a gate driver **400**, a data driver **500**, a user analyzer **600**, a gamma corrector **700**, and a gamma voltage generator **800**.

[0041] The display panel **200** displays an image. The display panel **200** includes, but is not limited to, an organic light emitting display panel, a liquid crystal display panel, a plasma display panel, an electrophoretic display panel, or an electrowetting display panel. Hereinafter, as an example, a liquid crystal display panel is used as the display panel **200**.

[0042] The display panel **200** includes a plurality of gate lines G**1** to Gk applied with a gate signal and a plurality of data lines D**1** to Dm applied with a data voltage. The gate lines G**1** to Gk are insulated from and cross the data lines D**1** to Dm. The display panel **200** includes a plurality of pixel areas arranged in a matrix form, and plural pixels are arranged in the pixel areas, respectively, As shown in FIG. **2**, an equivalent circuit of one pixel PXL of the pixels is shown as an example. The pixel PXL includes a thin film transistor **210**, a liquid crystal capacitor **220**, and a storage capacitor **230**.

[0043] According to an embodiment, the thin film transistor **210** includes a gate electrode, a source electrode, and a drain electrode, The gate electrode is connected to a first gate line G**1** of the gate lines G**1** to Gk, the source electrode is connected to a first data line DL**1** of the data lines D**1** to Dm, and the drain electrode is connected to the liquid crystal capacitor **220** and the storage capacitor **230**.

[0044] The display panel **200** includes a first display substrate, a second display substrate facing the first display substrate, and a liquid crystal layer disposed between the first display substrate and the second display substrate.

[0045] The first display substrate includes the gate lines G**1** to Gk, the data lines D**1** to Dm, the thin film transistor **210**, and a pixel electrode (not shown) that functions as a first electrode of the liquid crystal capacitor **220**. The thin film transistor **210** applies the data voltage to the pixel electrode in response to the gate signal.

[0046] The second display substrate includes a common electrode (not shown) that functions as a second electrode of the liquid crystal capacitor **220**. The common electrode is

applied with a reference voltage. The liquid crystal layer is disposed between the pixel electrode and the common electrode and functions as a dielectric substance. The liquid crystal capacitor **220** is Charged with a voltage corresponding to an electric potential between the data voltage and the reference voltage.

[0047] The timing controller **300** receives image data Data and control signals cont from an outside source of the image display part **1000**. The control signals include a horizontal synchronization signal, a vertical synchronization signal, a main clock signal, and a data enable signal.

[0048] The timing controller **300** converts a data format of the image data Data to a data format suited for an interface between the data driver **500** and the timing controller **300** and applies the converted image data Data**1** to the data driver **500**. The timing controller **300** applies a data control signal cont**1**, such as an output start signal, a horizontal start signal, a horizontal dock signal, or a polarity inversion signal, to the data driver **500** and applies a gate control signal cont**2**, such as a vertical start signal, a vertical dock signal, or a vertical clock bar signal, to the gate driver **400**.

[0049] The gate driver **400** is electrically connected to the gate lines G**1** to Gk disposed on the display panel **200** and applies the gate signal to the gate lines G**1** to Gk. For example, the gate driver **400** generates the gate signal to drive the gate lines G**1** to Gk in response to the gate control signal cont**2** from the timing controller **300** and sequentially applies the gate signal to the gate lines G**1** to Gk.

[0050] The data driver **500** selects some of a plurality of gamma voltages GMM**1** to GMMi, which correspond to the converted image data data**1** in response to the data control signal cont**1** provided from the timing controller **300** and generates data voltages, and applies the generated data voltages to the data lines D**1** to DM.

[0051] The user analyzer **600** receives the user image signal m**1** from the camera **100** and calculates the user's viewing direction based on the user image signal m**1**. The user analyzer **600** generates a user position signal m**2** including information about the user's viewing direction and applies the user position signal m**2** to the gamma corrector **700**.

[0052] The image display part **1000** further includes a first look-up table LUT**1** that stores a gamma value corresponding to the viewing direction.

[0053] The gamma corrector **700** reads out the gamma value corresponding to the viewing direction from the first look-up table LUT**1** and generates a correction gamma value gc. The gamma corrector **700** applies the correction gamma value gc to the gamma voltage generator **800**.

[0054] The gamma voltage generator **800** generates the gamma voltages GMM**1** to GMMi, which have been previously set for gray-scale levels, respectively, in accordance with a gamma curve of the correction gamma value gc and applies the gamma voltages GMM**1** to GMMi to the data driver **500**.

[0055] FIG. **3** is a block diagram showing the user analyzer **600** shown in FIG. **2**.

[0056] Referring to FIG. **3**, the user analyzer **600** includes a facial recognizer **610** and a viewing direction calculator **630**.

[0057] The facial recognizer **610** extracts positions of a user's eyes, nose, and mouth based on the user image signal m**1** and recognizes the user's facial features. According to an embodiment, when the facial recognizer **610** does not recognize the user's facial features, the image display part **1000** operates in a power saving mode after a predetermined time.

[0058] The viewing direction calculator **630** calculates the user's viewing direction based on the positions of the eyes, nose, and mouth. For example, the viewing direction calculator **630** calculates the viewing direction based on a center point of the user's two eyes and the upper and lower view angle and the left and right view angle of the camera part **100**. According to an embodiment, the viewing direction calculator **630** calculates the user's upper and lower view angle and left and right view angle.

[0059] FIG. **4** is a view for describing a process of calculating a user's viewing direction.

[0060] For convenience of description, FIG. **4** shows the user that looks down the image display part **1000** from a front upper side of the image display part **1000**. However, according to an embodiment, the process of calculating the viewing direction applies to an example where the user views the image display part **1000** from lower, left, and right sides of the image display part **1000**. For purposes of description, the user image signal m**1** is represented as a user image img.

[0061] Referring to FIGS. **3** and **4**, the camera part **100** has a preset upper and lower view angle θ**1**. The viewing direction calculator **630** determines that the user looks down the image display part **1000** when the user's face is positioned over a reference position rr in the user image img. According to an embodiment, the reference position rr is predetermined in the user image img, and as an example, the reference position rr is positioned at a center point of the user image img in FIG. **4**. The viewing direction calculator **630** calculates the center point cc between the two eyes in the face fc and calculates a view angle θ**2** based on the center point cc and the upper and lower view angle θ**1**. For instance, when the upper and lower view angle θ**1** is about 45 degrees and when the center point cc is determined to be positioned at an upper central portion in the user image img, the view angle θ**2** is about +22.5 degrees. Similarly, the view angle θ**2** is about −22.5 degrees when it is determined that the center point cc is positioned at a lower central portion of the user image img. The viewing direction calculator **630** stores a plurality of view angles corresponding to positions of the center point cc.

[0062] FIG. **5**A is a graph showing gamma curves according to view angles, and FIG. **5**B is a graph showing gamma curves obtained by compensating for the gamma curves shown in FIG. **5**A.

[0063] Referring to FIGS. **2** and **5**A, there are differences between the gamma curves obtained when the user views the image display part **1000** from front, upper, and lower sides of the image display part **1000**. For example, the brightness perceived by the user is relatively higher when the user looks down the image display part **1000** than when the user views the image display part **1000** from the front side of the image display part **1000**. The brightness perceived by the user is relatively lower when the user looks up the image display part **1000** than when the user views the image display part **1000** from the front side of the image display part **1000**.

[0064] The correction gamma values that correct the gamma curves in accordance with the user's view angles are shown in Table 1:

TABLE 1

View angle	−20 deg.	−10 deg.	0 deg.	10 deg.	20 deg.
Correction gamma value	1.2	1.7	2.2	2.6	3

[0065] Referring to Table 1, when the user looks up the image display part **1000** and the view angle is about 20 degrees, the gamma corrector **700** selects the correction gamma value of about 1.2. Similarly, when the user looks down the image display part **1000** and the view angle is about 20 degrees, the gamma corrector **700** selects the correction gamma value of about 3.

[0066] When the correction gamma values are applied, the gamma curves are substantially the same regardless of the view angles as shown in FIG. **5**B.

[0067] The image display system may provide the image having optimized gamma curve to the user in real time even without a separate input from the user.

[0068] FIG. **6** is a block diagram showing an image display system according to an exemplary embodiment of the present invention.

[0069] The image display system has the same or substantially the same in configuration and functions as the image display system described in connection with FIG. **2** except that the image display system illustrated in FIG. **6** further includes a light controller **900** and a light source **910**.

[0070] Referring to FIG. **6**, the light source **910** is disposed under the display panel **200** and supplies light to the display panel **200**. According to an embodiment, a plurality of light sources **910** are provided. According to an embodiment, the light source **910** includes a point light source, such as a light emitting diode (LED), or a line light source, such as a cold cathode fluorescent lamp (CCFL).

[0071] The light source controller **900** controls the light source **910**, The light source controller **900** receives the user position signal m**2** from the user analyzer **600** and controls the brightness of the light source **910** based on the viewing direction. For instance, the light source controller **900** controls the light source **910** so that the brightness of the light source **910** decreases when the user looks down the image display part **1000** since the brightness perceived by the user is relatively higher when the user looks down the image display part **1000** than when the user views the image display part **1000** from the front of the image display part **1000**. The light source controller **900** controls the light source **910** so that the brightness of the light source **910** increases when the user looks up the image display part **1000** since the brightness perceived by the user is relatively lower when the user looks up the image display part **1000** than when the user views the image display part **1000** from the front of the image display part **1000**. The image display system may provide an image having an optimized gamma curve to the user in real time even without a separate input from the user.

[0072] FIG. **7** is a block diagram showing an image display system according to an exemplary embodiment of the present invention,

[0073] The image display system has the same or substantially the same in configuration and functions as the image display system described in connection with FIG. **2** except that the image display system illustrated in FIG. **7** further includes a speaker module **950** and includes a different configuration of the user analyzer.

[0074] Referring to FIG. **7**, the user analyzer **601** generates a user position signal m**3** including information about a user's viewing direction and viewing distance and applies the user position signal m**3** to the gamma corrector **700** and the speaker module **950**.

[0075] The speaker module **950** outputs a sound in synchronization with an image displayed on the display panel **200**. The speaker module **950** receives sound data s-data from an external source (not shown), a sound synchronization signal cont**3** from the timing controller **300**, and the user position signal m**3** from the user analyzer **600**. The sound synchronization signal cont**3** is used to synchronize the image displayed on the display panel **200** with the sound.

[0076] The speaker module **950** corrects an output level and timing of the sound data s-data based on the user position signal m**3** and outputs the sound.

[0077] FIG. **8** is a block diagram showing the user analyzer shown in FIG. **7**.

[0078] Referring to FIG. **8**, the user analyzer **601** includes as facial recognizer **610**, a viewing distance calculator **620**, and a viewing direction calculator **630**. The facial recognizer **610** and the viewing direction calculator **630**, respectively, have the same or substantially the same in structure and functions as the facial recognizer and the viewing direction calculator described in connection with FIG. **3**.

[0079] The viewing distance calculator **620** calculates a distance, e.g., a viewing distance, between the image display part **1000** and the user. For example, the viewing distance calculator **620** stores a plurality of viewing distance values in accordance with the size of the user's face and calculates the viewing distance based on the size of the user's face extracted from the user image signal m**1**.

[0080] FIG. **9** is a block diagram showing the speaker module shown in FIG. **7**.

[0081] Referring to FIG. **9**, the speaker module **950** includes a sound corrector **960** and a speaker **970**. The sound corrector **960** receives the sound data s-data and the user position signal m**3**. The sound corrector **960** corrects the output level and the output timing of the sound data s-data based on the user's viewing distance and viewing direction included in the user position signal m**3** and generates corrected sound data s-data**1**.

[0082] The speaker **970** receives the corrected sound data s-data**1** and outputs the sound.

[0083] The image display system may provide an image having an optimized gamma curve to the user in real time even without the user's separate input.

[0084] FIG. **10** is a block diagram showing an image display system according to an exemplary embodiment of the present invention.

[0085] The image display system have the same or substantially the same in configuration and functions as the image display system described in connection with FIG. **2** except that the timing controller has a different configuration, a second look-up table LUT**2** is included, the gamma voltage generator **850** has different functions, and the first look-up table LUT**1** and the gamma corrector **700** are not provided. The image display system further includes a second look-up table LUT**2** that stores a plurality of data values corresponding to the viewing direction.

[0086] The timing controller **350** receives image data Data and control signals cont from an outside source of the image display part **1000**. The timing controller **350** receives a user position signal m**2** from the user analyzer **600**. The control

signals cont include a horizontal synchronization signal, a vertical synchronization signal, a main clock signal, and a data enable signal.

[0087] The timing controller **350** corrects the image data Data based on the viewing direction of the user and converts a data format of the corrected image data Data to a data format suited for an interface between the data driver **500** and the timing controller **300** and applies the converted image data data**2** to the data driver **500**. The timing controller **350** applies a data control signal cont**1**, such as an output start signal, a horizontal start signal, a horizontal clock signal, or a polarity inversion signal, to the data driver **500** and applies a gate control signal cont**2**, such as a vertical start signal, a vertical clock signal, or a vertical clock bar signal, to the gate driver **400**.

[0088] The timing controller **350** includes a data corrector **360**. The data corrector **360** receives the user position signal m**2** and corrects the image data Data based on the user's viewing direction. According to an embodiment, the data corrector **360** reads out a data value from the second look-up table LUT**2**, which corresponds to the viewing direction of the user, and generates the corrected image data. The data corrector **360** corrects gray scale information and brightness information of the image data Data.

[0089] The gamma voltage generator **850** generates the gamma voltages GMM**1** to GMMi in accordance with a predetermined gamma curve and applies the gamma voltage GMM**1** to GMMi to the data driver **500**. Different from the image display system described in connection with FIG. **2**, the image display system illustrated in FIG. **10** corrects the image data Data without correcting the gamma value. The image display system may provide an image having an optimized gamma curve to the user in real time even without a separate input from the user.

[0090] FIG. **11** is a flowchart illustrating a method of driving an image display system according to an embodiment of the present invention.

[0091] A user's picture is taken or the user's image is captured, and a user image signal is generated (S**10**). The user's viewing direction is calculated based on the user image signal (S**30**). A correction gamma value is generated based on the user's viewing direction (S**50**). A gamma voltage is generated based on the correction gamma value (S**70**). An image corresponding to the gamma voltage is displayed (S**90**).

[0092] FIG. **12** is a flowchart illustrating a method of driving an image display system according to an embodiment of the present invention.

[0093] A user's picture is taken or the user's image is captured, and a user image signal is generated (S**20**). A viewing direction of the user is calculated based on the user image signal (S**40**). Image data is corrected based on the viewing direction of the user (S**60**). An image corresponding to the corrected image data is displayed (S**80**).

[0094] Although the exemplary embodiments of the present invention have been described, it is understood that the present invention should not be limited to these exemplary embodiments but various changes and modifications can be made by one ordinary skilled in the art within the spirit and scope of the present invention as hereinafter claimed.

What is claimed is:

1. An image display system comprising:

a camera part configured to take a picture of a user and configured to generate a user image signal;

a user analyzer configured to receive the user image signal and configured to calculate a viewing direction and a viewing distance of the user based on the user image signal;

a gamma corrector configured to generate a correction gamma value based on the viewing direction and the viewing distance;

a gamma voltage generator configured to generate a gamma voltage based on the correction gamma value;

a display panel configured to display an image corresponding to the gamma voltage; and

a speaker module configured to output a sound synchronized with the image.

2. The image display system of claim **1**, wherein the user analyzer comprises:

a facial recognizer configured to receive the user image signal and configured to recognize a face of the user; and

a viewing distance calculator configured to calculates the viewing distance based on a size of the face; and

a viewing direction calculator configured to calculate the viewing direction of the user based on the viewing distance and a position of the face.

3. The image display system of claim **1**, wherein the speaker module comprises:

a sound corrector configured to receive sound data and generate corrected sound data based on the viewing distance and the viewing direction; and

a speaker configured to receive the corrected sound data and configured to output the sound.

4. The image display system of claim **3**, wherein the sound corrector is configured to correct an output level and an output timing of the sound data and configured to generate the corrected sound data.

5. An image display system comprising:

a camera part configured to take a picture of a user and configured to generate a user image signal;

a user analyzer configured to receive the user image signal and configured to calculate a viewing direction of the user based on the user image signal;

a timing controller configured to receive image data and correct the image data based on the viewing direction; and

a display panel configured to display an image corresponding to the corrected image data.

6. The image display system of claim **5**, further comprising a look-up table configured to store a correction data value corresponding to the viewing direction.

7. A method of driving an image display system, the method comprising:

taking a picture of a user and generating a user image signal;

calculating a viewing direction of the user based on the user image signal;

correcting image data based on the viewing direction of the user; and

displaying an image corresponding to the corrected image data,

8. An image display system comprising:

a camera configured to generate an image signal of a user;

a user analyzer configured to generate positional information of the user from the image signal; and

a gamma corrector configured to correct a first gamma value into a second gamma value corresponding to the positional information.

9. The image display system of claim **8**, further comprising a speaker module configured to output a sound whose magnitude corresponds to the positional information.

10. The image display system of claim **8**, further comprising a light source controller configured to adjust brightness of a light source according to the positional information.

11. The image display system of claim **8**, further comprising a data corrector configured to change a data format of an image corresponding to the image signal of the user into another data format.

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